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OP 1793

2″.75 FOLDING-FIN AIRCRAFT ROCKET

DESCRIPTION AND INSTRUCTIONS FOR USE

DEPARTMENT OF THE NAVY
BUREAU OF ORDNANCE

14 SEPTEMBER 1954

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Chapter 1

INTRODUCTION

The 2".75 Folding-Fin Aircraft Rocket (FFAR), figure 1, is an air-to-air projectile developed to provide efficient armament for modern high-speed fighter and interceptor aircraft.

The rocket is composed basically of Fuse Mk 176 which has a delay element or Fuze Mk 178 which does not have a delay element, an ogival steel head threaded internally at the forward end for attachment of the fuze and externally at the after end for attachment of the motor, and a motor assembly.

General Description

For air-to-air firing, the rocket is designed to make direct hits, penetrate the outer skin of an aircraft, and then detonate within the aircraft structure. This intended operation of the rocket is based on tests which established that aircraft are more vulnerable to internal explosions.

In keeping with the intended operation, the rocket is designed with a steel head, which remains intact after striking and penetrating an aircraft, and which is fitted with a point detonating fuze incorporating a delay element. The delay allows the head of the rocket to penetrate an aircraft structure before detonating.

Although originally designed for air-to-air use, the 2".75 FFAR has proved to be a potent air-to-ground weapon against a wide variety of targets. For air-to-ground firing, the FFAR usually is equipped with a nondelay fuze.

At present Mk 1 and Mk 5 heads are issued for use with the 2".75 FFAR. An explanation stencilled on the head designates the type of filler (inert or explosive (HBX)).

Explosive loaded heads are painted olive drab, inert loaded heads are painted light blue, and heads for dummy (drill) round are painted black. Inert loaded heads are issued with a dummy nose fuze.

Explosive loaded Mk 1 heads may be issued with either Fuze Mk 176 which has a delay element, or Fuze Mk 178 which is a point-detonating (PD) fuze.

Other heads designed for use with this rocket are Mk 5 High-Explosive Anti-Tank (HEAT) with Fuze Mk 181, and Mk 3 and Mk 4 which are slug-type armor-piercing. The difference in construction of the latter two is that Mk 4 has a windscreen.

Currently three motors are used with the 2".75 FFAR: Mk 1 Mods 3 or 4, Mk 2 All Mods, Mk 3 All Mods. Motors Mk 1 Mod 0, Mk 1 Mod 1, and Mk 1 Mod 2 never were issued for service use. The Mk 2 All Mods incorporate a new propellant, while the Mk 3 All Mods add a flash suppressor.

The 2".75 motor has fins that fold within the 2.75-inch diameter of the rocket, which permits the FFAR to be fired from tubular launchers.

Heads for the FFAR can be attached to motors without special tools. The loaded motor without head assembled is nonpropulsive which eliminates danger in case of accidental ignition, and can be stored at moderate temperatures for reasonably long periods of time without deterioration.

Trajectory tables for the FFAR are in OP 1998. Physical characteristics of the rocket are the following:

Length, over-all (fins folded), inches	48
Diameter, inches	2. 75
Approximate weight, pounds:	
Round before firing	18. 1
Loaded and fuzed head	6. 5
CG of round (from nose), inches	19. 4
Service temperature limits, °F	*—65 to 150

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* *Although these limits are standard, they do not necessarily apply to all motors. Observe temperature limits on specific motor tubes.*

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TM 9-1055-217-20

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

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ORGANIZATIONAL MAINTENANCE MANUAL

HELICOPTER ARMAMENT SUBSYSTEM 2.75-INCH ROCKET LAUNCHER XM3 (USED ON UH-1B HELICOPTER)

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CHAPTER 8

AMMUNITION

8–1. Identification

a. Ammunition and ammunition components are completely identified by painting and marking (including an ammunition lot number) on the ammunition items and on all original packing containers.

b. To identify a particular design, a model designation is assigned at the time the item is classified as an adopted type. This model designation becomes an essential part of the nomenclature and is included in the marking on the item. The present system of model designation uses the letters "M" or "Mk" followed by an Arabic numeral, for example, "Mk 1". Modifications are indicated by adding the letters "A" or "Mod" and an Arabic numeral. For instance, "Mk 1 Mod 6" indicates the sixth modification of an item for which the original model designation was "Mk 1". development items are indicated by the letters "T" or "XM" and an Arabic numeral, and modification of them by the addition of "E" and an Arabic numeral.

c. When ammunition is manufactured, an ammunition lot number is assigned to it. This lot number is stamped or marked on every loaded item and on all packing containers. It is required for all records, including reports on condition, functioning, or accidents involving the ammunition. In any one lot of ammunition. The components used are manufactured under nearly identical conditions.

d. Warheads are painted to prevent rust and to provide type identification by the color. Lusterless paint is used for camouflage.

(1) Rocket motors are painted olive drab.

(2) High-explosive warheads are painted olive drab and marked in yellow.

(3) Practice warheads are painted blue and marked in white.

e. Standard markings are stenciled on the rocket according to the color scheme described in *d* above, or stamped into the metal.

(1) The following information appears on the warhead (stenciled, unless otherwise indicated):
  (*a*) Type, caliber, and model of rocket.
  (*b*) Ammunition lot number and loader's initials.
  (*c*) Month and year loaded.
  (*d*) The metal parts lot number, date (month and year) manufactured, caliber, and model designation (all stamped into the metal).

(2) The following information appears on the fuze, stamped into the metal:
  (*a*) Loader's lot number and date (month and year) loaded.
  (*b*) Type and model of fuze.

(3) The following information is stenciled on the motor:
  (*a*) Type, caliber, and model of the motor.
  (*b*) Drawing number.
  (*c*) Loader's initials and ammunition lot number.
  (*d*) Date (month and year) manufactured.

8–2. Care, Handling, and Preservation

Warning: **Handle ammunition or components containing explosives carefully. The explosive elements in igniters and fuzes are especially sensitive to physical shock and high temperature. Boxes containing ammunition should not be dropped, tumbled, or dragged.**

a. Ammunition is packed to withstand usual field conditions. Keep the packings from becoming broken or damaged. Repair all broken packings as soon as possible, and transfer all markings to the new parts.

b. When ammunition must be left in the open, raise it on dunnage at least six inches from the ground and cover it with a double thickness of tarpaulin, leaving enough space for the circulation of air. When possible, place dunnage strips under each layer of boxes or ammunition containers. Dig trenches to prevent water from running under the pile.

c. Explosives are easily damaged by moisture or high temperature.

(1) Do not break the moisture-resistant seals until the ammunition is to be used. Ammunition removed from airtight containers, particularly in damp climates, is apt to corrode. Badly corroded ammunition is unserviceable.

(2) Protect ammunition from high temperature and the direct rays of the sun. Do not store rockets where the temperature may exceed 160° F. More uniform firing results from the rounds all being the same temperature.

(3) When rockets are prepared for firing, but not fired, return them to their original condition and packings and mark them. Use such unpacked ammunition first in later firings so that stocks of opened packings will be kept to the minimum.

d. For additional instructions on care, handling, and preservation see TM 9-1900 and TM 9-1300-206.

8-3. Authorized Rounds

a. Ammunition authorized for use in helicopter-armament subsystem XM3 is listed in table 8-1. Standard nomenclature, which is used in the listing, completely identifies ammunition except for the ammunition lot number.

b. Two kinds of warheads are authorized.

(1) The high-explosive warhead Mk 1 and mods consists of a steel casing containing a 1.40-pound HBX-1 explosive charge. The warhead is internally threaded at the nose to receive the fuze, and externally threaded at the base to engage the motor. A threaded cup-shaped cavity liner is screwed into the nose.

(2) The practice warhead Mk 1 and mode is similar to the high-explosive warhead, except that it is inert loaded.

c. The motor Mk 2 and mods or Mk 4 and mods consists of an aluminum-alloy motor tube containing propellant and an igniter, and a nozzle-fin assembly which is attached to the rear end. The motor tube is internally threaded at the front end to receive the warhead.

(1) The propellant is one inhibited grain of ballistite.

(2) The igniter consists of a tin case containing a mixture of black powder and magnesium powder and an electric squib. It is located at the front end of the motor tube. Two lead wires extend from the squib through the perforation in the propellant grain to the nozzle-fin assembly, where one lead wire is grounded to the nozzle plate. The other lead passes through a nozzle and is connected to the contact disc at the rear end of the motor tube.

(3) The nozzle-fin assembly consists of a nozzle plate, four nozzle inserts, a fin-actuating mechanism, four fins, a fin retainer, and a contact disc. The rectangular fins are pivoted on the nozzle plate. As packed and shipped, the fins are within the 2.75-in, diameter of the rocket. When the rocket is fired, gas pressure working through the fin-actuating mechanism causes the fins to extend from the motor at a 45-degree angle. The contact disc, which is insulated from the rocket casing, is a live contact during firing.

d. The authorized fuse, PD fuze, Mk 176 and mods, is of the acceleration-arming, point-detonating, delay-element type. It is designed for delayed action; there is a delay element in the rotor between the primer and the detonator. The fuze cannot be detonated until armed by the acceleration of firing. Accelerations caused by rough handling, dropping, or helicopter flight will not arm it.

8-4. Assembly of Rockets

Some motors are dimpled. The dimple is a convex bulge in the forward end of the motor tube which contacts the base of the mounted warhead, helping to keep it tightly mounted. Most motors are undimpled. Assemble both dimpled and undimpled motors and warheads as follows:

a. Remove the fuzed warhead and motor from the container.

Table 8–1. Authorized Rounds

Standard nomenclature	Warhead Weight (lb)	Warhead Length (in.)	Motor Weight (lb)	Motor Length (in.)	Fuze Action	QD	Compatibility grouping
• ROCKET, HIGH EXPLOSIVE, 2.75-INCH: FFAR (unassembled)						10	F
Consists of:							
Warhead, 2.75-inch Mk 1 and mods • (HBX–1 loaded) w/fuze, PD, Mk 176 and mods	6.45	11			Delay .003 sec		
Rocket motor, 2.75-inch Mk 2 and mods or Mk 4 and mods w/propellant grain Mk 43 and mods			11.40	39.36			
ROCKET, INSERT, 2.75-INCH: FFAR (unassembled)							
Consists of:							
Warhead, 2.75-inch, Mk 1 Mod 3	6.45	11					
Rocket motor, 2.75-inch Mk Mod 3 w/wdn propellant grain, Mk 31 Mod 1			11.40	39.36			
Also							
Warhead, 2.75-inch rocket, inert, Mk 1 and mods						4	F
ROCKET, PRACTICE, 2.75-INCH: FFAR (unassembled)							
Consists of:							
Warhead, 2.75-inch Mk 1 and mods inert loaded	6.47	11					
Rocket motor, 2.75-inch, Mk 2 and mods or Mk 4 and mods w/propellant grain, Mk 43 and mods			11.40	39.36			

Caution: **When mating the warhead to the rocket motor, make sure that the spacer is between the warhead and motor in order to prevent separation during flight.**

b. Remove the warhead and the head shipping support from the motor. The shipping support is snap-fitted to the head closure in the motor. On some motors, there is a rubber gasket ring under the li pof the head shipping support and a shim between the head shipping support and head closure. Remove and dispose of the shim and gasket before threading the warhead to the motor. Within the forward two and one-half inches of the motor, hold the motor with a strap wrench. With a second strap wrench around the warhead, tighten the heads as much as possible without causing the head closure to turn or force the visible lockwire in or out of the elongated hole in the motor tube lockwire groove. Movement of the lockwire tab within the confines of the elongated hole is normal.

Caution: **Do not force lockwire tab down into the motor lockwire groove or out of the elongated hole. The enlarged tab traveling through the lockwire groove would bulge the motor tube and make it unsafe to fire. Motors with lockwire tabs displaced should be discarded as unserviceable.**

Col. George M. Chinn 1 OF 55

TM 9-1090-201-12

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

OPERATOR AND ORGANIZATIONAL MAINTENANCE MANUAL (INCLUDING REPAIR PARTS AND SPECIAL TOOL LISTS)

ARMAMENT SUBSYSTEM, HELICOPTER, 7.62–MM MACHINE GUN – 2.75–INCH ROCKET LAUNCHER: XM16 (USED ON UH–1B HELICOPTERS)

HEADQUARTERS, DEPARTMENT OF THE ARMY
SEPTEMBER 1965

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CHAPTER 4

AMMUNITION

4-1. 2.75-Inch Rockets

Refer to table 4-1.

Table 4-1. Authorized Rounds

Nomenclature	Warhead	Motor
ROCKET, HIGH EXPLOSIVE, 2.75-INCH: FFAR (unassembled)	Warhead, Mk 1 and mods (HBX-1 loaded) w/fuze, PD, Mk 176 and mods.	Rocket motor, Mk 2 and Mk 4 with mods, w/propellant Mk 43 and mods.
ROCKET, INERT, 2.75-INCH: FFAR (unassembled)	Warhead, 2.75-inch, Mk 1 Mod 3 and mods.	Rocket motor, 2.75-inch, Mk 1 Mod 3 with propellant, Mk 31 Mod 1.
ROCKET, PRACTICE, 2.75-INCH: FFAR (unassembled)	Warhead, 2.75-inch, Mk 1 and mods, inert loaded.	Rocket motor, Mk 2 and Mk 4 with mods, with propellant, Mk 43 and mods.

4-2. 7.62-Millimeter Cartridges

Refer to TM 9-1005-243-12.

TM 9-1090-202-12

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

OPERATOR AND ORGANIZATIONAL MAINTENANCE MANUAL (INCLUDING REPAIR PARTS AND SPECIAL TOOL LISTS)

ARMAMENT SUBSYSTEM, HELICOPTER, 7.62 MILLIMETER MACHINE GUN-2.75-INCH ROCKET LAUNCHER: TWIN, HIGH RATE, XM21 (USED ON UH-1B HELICOPTERS)

This copy is a reprint which includes current pages from Change 1.
Pen and ink changes have been made.

HEADQUARTERS, DEPARTMENT OF THE ARMY
MAY 1966

CHAPTER 4

AMMUNITION

(Superseded)

4-1. 7.62 Millimeter Cartridges

a. General. Ammunition for 7.62 millimeter weapons was developed with the intended purpose of replacing the caliber .30 carbine and caliber .30 weapon-ammunition systems with a family of cartridges adopted and standardized for interchangeable use by the North Atlantic Treaty Organization (NATO) countries. Ammunition intended for this standardized (NATO) use is identified by means of the symbol (+) stamped on the head of each service type cartridge. Ammunition lots qualified for interchangeable use in the M14 rifle, the M60 machine gun as well as the rifles and machine guns adopted by the other NATO countries shall be identified by means of a clover leaf symbol stamped on the outer shipping containers. Ammunition of foreign manufacture bearing both symbols is equally usable in U. S. weapons. Issue and use of individual cartridge lots in the appropriate types of weapons shall comply with the ammunition lot grades and authorization noted in TB 9-AMM 4.

b. Ball NATO 7.62 Millimeter Cartridge M59. This cartridge is intended for use against personnel and unarmored targets.

c. Ball NATO 7.62 Millimeter Cartridge M80. This cartridge is intended for use against personnel and unarmored targets

d. Tracer NATO 7.62 Millimeter Cartridge M62. This cartridge is intended for use primarily as a visual means of observing the trajectories (flight) and points of target impact of other service type cartridges and for signaling. It is also effective against personnel and unarmored targets.

e. AP NATO 7.62 Millimeter Cartridge M61. This cartridge is intended for use against light armored targets.

f. NATO 7.62 Millimeter Dummy Cartridge XM172 (Insert Loaded).

(1) *Cartridge.* This cartridge is intended for use in training personnel in the handling and loading of 7.62 millimeter weapons. The cartridge contains an inert materiel in lieu of propellant to simulate the normal weight and balance of the ball cartridge M80. This cartridge may be identified by the absence of a primer in the head of the cartridge case and its black external oxide finish.

(2) *Case.* Except for the absence of a vent hole under the primer pocket, and the NATO symbol (+), not stamped on the head of the case, it is identical to the case used for service type cartridges.

g. General, Physical, and Ballistic Data for 7.62 Millimeter Ammunition. Refer to table 4-1 and TM 9-1305-200.

4-2. 2.75-Inch Rocket

a. General. The 2.75-inch fin-stablized aircraft rocket is a Navy type used by the United States Air Force for forward-firing from an aircraft rocket launcher. Authorized rounds are shown in table 4-2. Stablization in flight is accomplished by four pivoted fins folded within the cross section of the rocket during packing and shipping. The pressure of the pro-

Table 4-1. Physical and Ballistic Data for 7.62 Millimeter Ammunition

	CARTRIDGE							
Velocity, range, weight, length	BALL, M59	BALL, M80		TRACER, M62		AP, M61	DUMMY, M172 (inert-loaded)	
	G.M.[1]	G.M.[1]	G.M.C.S.[2]	G.M.[1]	G.M.C.S.[2]	G.M.[1]	G.M.[1]	G.M.C.S.[2]
Velocity (f/s)	Nominal							
Muzzle	2809	2809	2809	2731	2804	N.R.[3]	----	----
78 ft	2750	2750	2750	2680	2750	2750	----	----
600 yds	1619	1614	1614	1681	1696	N.R.[3]	----	----
Maximum range (yds)	4180	4300	4300	2560	2560	4180	----	----
Accuracy (mean radius (in.)								
Measured at 600 yds	Average	Maximum						
Machine gun	7.5	7.5	7.5	15.0	15.0	7.5	----	----
Rifle	7.5	5.0	5.0	15.0	15.0	7.5	----	----
Drop at 600 yards (in.)	Nominal							
	116	116	116	117	112	N.R.[3]	----	----
Cartridge weight (gr)	393	392	392	387	382	393	385	385
Bullet weight (gr)	150	149	149	146	141	150	149	149
Propellant weight (gr)								
WC 846	46	46	46	46	46	46	----	----
IMR 4475	41	41	41	----	----	41	----	----
IMR 8138M	----	41.5	41.5	----	----	----	----	----
Inert mix	----	----	----	----	----	----	46	46
Cartridge length (in.)	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80
Bullet length (in.)	1.28	1.18	1.14	1.35	1.35	1.28	1.18	1.14

[1] G.M.—Gilding Metal (Bullet Jacket Material)

[2] G.M.C.S.—Gilding Metal, Clad Steel (Bullet Jacket Material)

[3] N.R.—No Record

pellant gases actuates a piston and crosshead which pushes against the heels of the fins extending them at a 45° angle during flight. The rocket is fired from a launcher consisting of multiple nested tubes arranged in various configurations. Electrical energy to fire the rocket is derived from the electrical system of the aircraft. A rocket consists of a nose, fuze, head (warhead), and motor.

b. Head. Dependent upon the head, the rocket is classified as high explosive (HE), high explosive antitank (AT), smoke (WP), or practice (inert). The head is internally threaded at the nose to receive the fuze and externally threaded at the base to engage the motor.

c. Motor. The motor is internally threaded to receive the head. It consists essentially of an aluminum alloy motor tube containing propellant and an igniter and having a nozzle-fin assembly attached to the aft end. Some rocket motors are designed with two crimps, 180° apart at the forward end of the motor tube and are known as dimpled motors. However, it is more common to find rocket motors undimpled.

d. Propellant. Refer to table 4-2 and TM 9-1950.

e. Igniter. The igniter is a metal case containing a mixture of black powder and magnesium powder and an electric squib and is located in the forward end of the motor. Two lead wires from the squib extend from the igniter passing through the perforation in the propellant gain to the nozzle-fin assembly where one lead wire is grounded to the nozzle plate. The other lead wire passes through a nozzle and is connected to the contact disk at the aft end of the rocket as the live contact.

f. Nozzle-Fin Assembly. The nozzle-fin assembly consists essentially of a nozzle plate, four nozzle inserts, a fin-actuating mechanism, four fins, a fin retainer and a contact disk. The fins are rectangular and pivoted on the nozzle plate.

Table 4–2. Authorized Rounds

Nomenclature	Warheads	Motor
ROCKET, HIGH EXPLOSIVE, 2.75-INCH: LSFFAR (unassembled)	Warhead, Mk 1 and mods (HBX–1 loaded) w/fuze, PD, Mk 176 and mods	Rocket motors, Mk 2 and Mk 4 with mods, w/propellant Mk 43 and mods.
	or Warhead, M151 (XM151), (Comp B–4 loaded) w/fuze, rocket, M423 (XM-423).	Rocket motor, Mk 40, w/mods, w/propellant Mk 43 and mods.
ROCKET, SMOKE, W.P. 2.75-INCH: LSFFAR (unassembled)	Warhead, E–12 and mods (white phosphorus loaded w/HE burster) w/fuze, PD, Mk 176 and mods, or fuze, rocket M423 (XM423)	Rocket motors, Mk 2 and Mk 4 with mods, w/propellant Mk 43 and mods.
	or Warhead, M156 (E–13), (white phosphorus loaded w/HE burster) w/fuze, rocket, M423 (XM423).	Rocket motor, Mk 40, with mods, w/propellant Mk 43 and mods.
ROCKET, INERT, 2.75-INCH: LSFFAR (unassembled)	Warhead, 2.75-inch, Mk 1 Mod 3 and mods (inert loaded) w/fuze, Mk 176 (inert or dummy)	Rocket motor, 2.75-inch, Mk 1 Mod 3, w/propellant Mk 31 Mod 1.
	or Warhead, 2.75-inch, M151 (XM151) (inert loaded) w/fuze, rocket M423 (XM423), (inert or dummy).	Rocket motor, 2.75-inch, Mk 40, with mods (inert loaded).
ROCKET, PRACTICE, 2.75-INCH: LSFFAR (unassembled)	Warhead, 2.75-inch, Mk 1 and mods (inert loaded) w/fuze, Mk 176 (inert or dummy)	Rocket motors, Mk 2 and Mk 4 with mods, w/propellant Mk 43 and mods.
	or Warhead, 2.75-inch, M151 (XM151) (inert loaded) w/fuze, rocket, M423 (XM423) (inert or dummy).	Rocket motor, Mk 40, with mods, w/propellant Mk 43 and mods.
ROCKET, SMOKE, RED, 2.75-INCH: LSFFAR (unassembled)	Warhead, 2.75-inch, XM152 w/HE bursting charge w/fuze, rocket, M423 (XM423).	Rocket motor, Mk 40, with mods, w/propellant Mk 43 and mods.
ROCKET, SMOKE, YELLOW, 2.75-INCH: LSFFAR (unassembled)	Warhead, 2.75-inch, XM153 w/HE bursting charge w/fuze, rocket, M423 (XM423).	Rocket motor, Mk 40, with mods, w/propellant Mk 43 and mods.

g. Fuze. A fuze is a device used with an item of ammunition to cause it to function at the time and under the circumstances desired.

h. Identification. The rocket is identified by the folded fins, and contact disk at the aft end. Painting and marking are in accordance with that prescribed in TM 9–1900.

4–3. Precautions in Firing

General precautions are found in TM 9–1950. However, the following precautions are also applicable to 2.75-inch rockets:

a. Do not remove the fuze cavity liner.

b. Rockets which have a gap between head and motor should not be used.

c. All firing circuits should be open at the time the rocket is installed in the aircraft.

d. The fin protector should not be removed until immediately before loading ammunition in the launcher.

4–4. Preparation for Firing

a. Assembled Rockets.

(1) Remove from packing and inspect for serviceability.

(2) Should it be considered necessary to test for continuity, test with the circuit continuity tester as described in TM 9–1950. Basically, a continuity tester is an electric instrument based on the Wheatstone bridge principle.

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FM 1-40

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ATTACK HELICOPTER GUNNERY

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JUNE 1969

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b. To allow detonation at impact angles of from 90° to low graze angles of 5°, 40mm ammunition is provided with the M533 fuze.

K–7. 2.75-Inch Folding Fin Aerial Rockets (FFAR)

a. Launchers for the 2.75-inch FFAR include—

(1) XM141—seven tube, reloadable, reusable.

(2) XM157—seven tube, reloadable, reusable, not repairable.

(3) XM157B—seven tube, reloadable, reusable, extra long.

(4) XM158—seven tube, reloadable, resuable, repairable.

(5) XM159—19 tube reloadable, reusable, not repairable.

(6) XM159C—19 tube, reloadable, reusable.

★(7) XM200E1—19 tube, reloadable, reusable, repairable.

b. Warheads for the 2.75-inch FFAR are—

(1) Mk1—high explosive, 6 lb.

(2) Mk67—white phosphorous, 6 lb.

(3) M151—high explosive, 10 lb.

(4) XM152—high explosive, white phosphorous, red marker, 6 lb.

(5) XM153—high explosive, white phosphorous, yellow marker, 6 lb.

(6) M156—white phosphorous, 10 lb.

(7) XM157—smoke, red, 10 lb.

(8) XM158—smoke, yellow, 10 lb.

(9) XM229—high explosive, 17 lb.

(10) XM230—practice, 10 lb.

(11) XM232—practice, spotting, 10 lb.

(12) WDU—44/A—flechette, 10 lb.

c. Fuzes for the 2.75-inch FFAR include—

(1) M423E1—PD (graze sensitive).

(2) XM427—redesign of M423 to allow delayed arming.

(3) M429—proximity.

d. Types of 2.75-inch FFAR motors are—

(1) Mk4—high speed (unscarfed).

(2) Mk40—low speed (scarfed).

(3) Mk40—low speed (scarfed), redesign of Mk40.

K–8. M22 Missile Subsystem Ammunition

Ammunition for the M22 subsystem includes an AGM–22B guided missile with high explosive antitank warhead, an ATM–22B guided missile with inert warhead filled with a marking powder, and an ATM guided missile with completely inert warhead.

K–9. Munitions for Special Attack Helicopter Missions

The munitions listed below are not normally used in attack or limited attack helicopter roles and missions. However, they could be used on attack helicopters during special missions.

a. XM147—bomb, fragmentation (XM9).

b. XM142—bomb, antitank (XM9).

c. XM144—bomb fragmentation (XM25).

d. XM920E2—bomb, fuze and burster, CS in 55-gallon drum.

e. Mk24—flare, aircraft, parachute.

f. E158—50 lb. CS canister cluster.

g. E159—130 lb. CS canister cluster (two E/58 with strongback).

h. Helicopter trap weapon—to sanitize landing zones.

i. Fuel—air explosive, to sanitize landing zones.

j. E39R1—smoke tank (Kellet pylon).

k. XM52—smoke generator, exhaust stack mounted.

FM 1-40 S/Sby TC 1-4 Sep 76

Reference

FM 1-40

FIELD MANUAL

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b. All 40mm cartridges are fixed type ammunition and are ready for use as issued. All rounds except the XM684 cartridge utilize point detonating (PD) fuzes which allow functioning at impact angles from 90° to 30° (low graze).

C–7. 2.75-Inch Folding Fin Aircraft Rockets (FFAR)

a. Launchers for the 2.75-inch FFAR are—

(1) M158A1—seven tube, reloadable, reusable, repairable.

(2) M200A1—19 tube, reloadable, reusable, repairable.

b. Warheads for the 2.75-inch FFAR are—

(1) MK1—high explosive, 6 lb.

(2) MK5—HEAT.

(3) MK67—white phosphorous, 6 lb.

(4) M151—high explosive, 10 lb.

(5) XM152—high explosive, white phosphorous, red marker, 6 lb.

(6) XM153—high explosive, white phosphorous, yellow marker, 6 lb.

(7) M156—white phosphorous, 10 lb.

(8) XM157—smoke, red, 10 lb.

(9) XM158—smoke, yellow, 10 lb.

(10) M229—high explosive, 17 lb.

(11) M230—practice, 10 lb.

(12) XM232—practice, spotting, 10 lb.

(13) XM247—dual-purpose (antitank/antipersonnel), 10 lb.

(14) WDU 4 A/A—flechette, 10 lb.

c. Fuzes for the 2.75-inch FFAR include—

(1) M423—PD (graze sensitive).

(2) XM427—redesign of M423 to allow delayed arming.

(3) M429—proximity.

(4) M435—dummy.

(5) M440—dual purpose impact (superquick or delay) bunker defeating.

d. Types of 2.75-inch FFAR motors are—

(1) MK4—(unscarfed) for high performance delivery.

(2) MK40—(scarfed) for low speed aircraft delivery.

C–8. M22 Missile Subsystem Ammunition

Ammunition for the M22 subsystem includes an AGM–22B guided missile with high explosive antitank warhead, an ATM–22B guided missile with inert warhead filled with a marking powder, and an ATM guided missile with completely inert warhead.

C–9. Munitions for Special Attack Helicopter Missions

The munitions listed below are not normally used in attack or limited attack helicopter roles and missions. However, they could be used on attack helicopters during special missions.

a. XM52—smoke generator, exhaust stack mounted.

b. XM147—bomb, fragmentation (XM9).

c. XM142—bomb, antitank (XM9).

d. XM144—bomb, fragmentation (XM25).

e. XM920E2—bomb, fuze and burster, CS in 55-gallon drum.

f. MK24—flare, aircraft parachute.

g. MK45—improved flare, aircraft parachute.

h. E39R1—smoke tank.

i. E158—50 lb. CS canister cluster.

j. E159—130 lb. CS canister cluster (two E/58 with strongback).

k. Helicopter trap weapon—to sanitize landing zones.

l. Fuel—air explosive, to sanitize landing zones.

Section II. HELICOPTER ARMAMENT SUBSYSTEM DATA

C–10. Armament Subsystem Performance

Various armament configurations for the AH–1G and UH–1B/C/M attack helicopters are shown in figures C–1 and C–2. All possible combinations are not shown. For AH–1G armament subsystem performance data, see table C–1. For AH–1G and UH–1B/C/M performance data, see table C–2.

C–11. Attack Helicopter Performance Data

For attack helicopter performance data utilizing various ammunition loads, see table C–3.

TECHNICAL MANUAL

ORGANIZATIONAL MAINTENANCE MANUAL
(INCLUDING REPAIR PARTS AND SPECIAL TOOLS LISTS)

2.75-INCH LOW SPIN, FOLDING FIN AIRCRAFT ROCKETS; 66-MM LIGHT ANTITANK WEAPON SYSTEMS; 3.5-INCH ROCKETS; AND M3A2E1 ROCKET MOTOR (JATO)

This copy is a reprint which includes current pages from Changes 1 and 2.

HEADQUARTERS, DEPARTMENT OF THE ARMY
JUNE 1973

Section III. 2.75-INCH LOW SPIN, FOLDING FIN AIRCRAFT ROCKETS (LSFFAR)

2-6. Description

The 2.75-inch LSFFAR's are air-to-ground rockets (fig. 2-3) designed for deployment from rotary-wing and other low-speed aircraft. Provided with a variety of warheads, 2.75-inch rockets have a wide tactical application with high point-target effectiveness. Except for the practice warhead, WTU-1/B, which is unfuzed, a complete round 2.75-inch rocket consists of a fuze, a warhead, and a fin-stabilized rocket motor. The type of warhead with which a round is assembled determines the classification of the complete round (as antipersonnel, HE, HEAT, smoke, or practice).

2-7. Data

NOTE

> The Mk 40, Mods 0, 1, and 3, are the only rocket motors currently authorized for Army use with 2.75-inch rockets. These motors are white with black markings and a brown band.

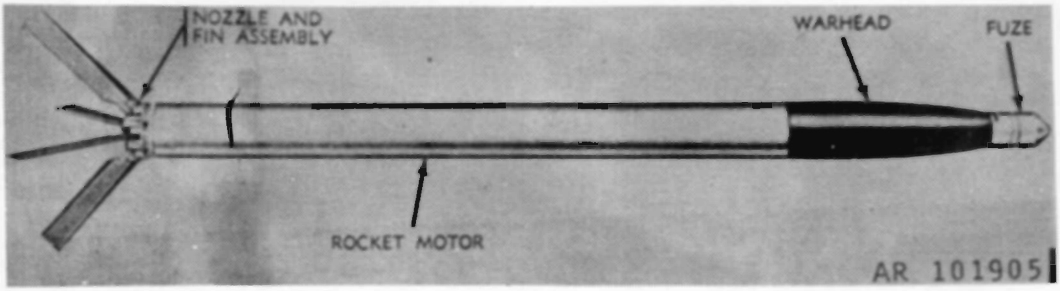

Figure 2-3. Typical complete round LSFFAR.

Characteristics of Army authorized complete round LSFFAR are tabulated below:

Warhead and fuze	Complete round weight (lb)	Complete round length (in.)	Color coding	DODIC
Flechette, WDU-4A/A w/integral fuze	20.2	54.6	Olive drab w/white marking and white diamonds.	H459
HE, M151 w/fuze M423	20.6	52.8	Olive drab w/yellow markings.	H490
HE, M151 w/fuze M429	20.8	54.7	Olive drab w/yellow markings.	H489
HE, M229 w/fuze M423	27.9	62.8	Olive drab w/yellow markings.	H534
HE, M229 w/fuze M429	28.2	64.7	Olive drab w/yellow markings.	H488
HEAT, Mk 5 w/fuze Mk 181	17.6	54.2	Black w/yellow markings.	H487
HEDP, M247 w/fuze M438	19.8	54.9	Black w/yellow markings.	H826
Smoke, WP, M156 w/fuze M423	20.6	52.2	Light green w/light red markings and one yellow band.	H519
Practice, WTU-1/B	20.8	52.8	Blue w/white markings.	H828
Flare, M257 w/Fuze M442	21.7	67.9	Olive drab w/white markings.	H180
Smoke, WP, M259 w/Fuze M446	19.5	63.8	Light green w/red markings and one yellow band.	H116
HE, M151 w/Fuze M433 RS	21.5	54.0	Olive Drab w/Yellow markings.	H471
HE, M151, w/Fuze M440	21.7	53.6	Olive Drab w/Yellow markings.	H161

Section IV. ROCKET MOTOR (JATO) M3A2E1

2-8. Description

Rocket Motor M3A2E1 (fig. 2-4) is a solid-propellant thrust unit. It is used primarily for launching target drones from a catapult, although it may be put to other uses requiring similar capability. The rocket motor consists of a body, nozzle, igniter assembly and propelling charge, and is electrically initiated.

2-9. Data

The following characteristics apply to the M3A2E1 Rocket Motor:

a. Weight—27.1 pounds

b. Dimensions—Length, 2.15 inches; diameter, 5.1 inches

c. Color Code—Olive drab w/yellow markings

d. DODIC—H304

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2-34. Aircraft Armament Subsystems Rockets.

2.75 inch Rockets*

TYPE	STDZN	PURPOSE	PACKAGING				DOT CLASS	FSC & DODIC	REMARKS Wpn Lchr M158A1 M200A1 M260 M261
			RDS/Per Box	Type	Cu Ft	Wt Lbs			
Rkt 2.75" Flech w/whd WDU-4A/A w/base fuze w/Mtr MK40	A	Anti-Personnel	4 and 25	Wood	3.0 17.9	127 776	A	1340-H459	Same
Rkt 2.75" HE w/whd M229 w/Fuze M429 w/Mtr MK40	A	Anti-Personnel	3, 4 and 25	Wood Wood Wood	3.6 3.47 20.8	134 162 996	A	1340-H488	Same
Rkt 2.75" HE w/whd M151 w/Fuze M429 w/Mtr MK40	A	Anti-Personnel	3, 4 and 25	Wood Wood Wood	3.0 3.0 17.9	107 127 776	A	1340-H489	Same
Rkt 2.75" HE w/whd M151 w/Fuze M423 w/Mtr MK40	A	Anti-Personnel Anti-Materiel	3, 4 and 25	Wood Wood Wood	3.0 3.0 17.9	107 127 776	A	1340-H490	Same
Rkt 2.75" SMK WP M156 w/Fuze M423 w/Mtr MK40	A	Target Marking & Incendiary	4	Wood	3.0	127	A	1340-H519	Same
Rkt 2.75" HE w/whd M229 w/Fuze M423 w/Mtr MK40	A	Anti-Personnel Anti-Materiel	3, 4 and 25	Wood Wood Wood	3.6 3.47 20.8	134 162 996	A	1340-H534	Same
Rkt 2.75" Practice WTU-1/B whd/slug w/Mtr MK40	A	Practice & Training	4 and 25	Wood Wood	3.0 17.9	127 776	B	1340-H828	Same

2-34. Aircraft Armament Subsystems Rockets (Cont).

2.75 inch Rockets*

TYPE	STDZN	PURPOSE	PACKAGING RDS/Per Box	Type	Cu Ft	Wt Lbs	DOT CLASS	FSC & DODIC	REMARKS Wpn Lchr M158A1 M200A1 M260 M261
Rkt 2.75" Flare w/whd M257 w/Fuze MBO w/Mtr MK40	A	Target Illumination	3 whds w/fuze, 3 Mtrs unassembled	Wood	3.0	117	A	1340-H180	Same
Rkt 2.75" Smoke Screening w/whd M259 w/Fuze MBO w/Mtr MK40	A	Battlefield Obscuration	4	Wood	3.5	135	A	1340-H116	Same
Rkt 2.75" HEDP whd M247 w/Fuze PIBD M438 w/Mtr MK40	A	Armor Piercing Anti-Personnel	4	Wood	3.47	147	A	1340-H826	Same
Rkt 2.75" HE w/whd M151 w/Fuze M433 w/Mtr MK40	A	Selectable Functioning f/Bunker Penetration & Anti-Personnel	4 and 19	Wood Metal	3.0 9.9	127 490	A	1340-H471	M200A1 Mod
Rkt 2.75" HE w/whd M151 Void sensing w/Mtr MK40	A	Anti-Bunker Anti-Canopy	4 and 25	Wood	3.0 16.5	127 776	A	1340-H161	Same

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TECHNICAL MANUAL

ARMY AMMUNITION DATA SHEETS
FOR

ROCKETS
ROCKET SYSTEMS
ROCKET FUZES
ROCKET MOTORS

(Federal Supply Class 1340)

This copy is a reprint which includes current pages from Change 1 through 7.

HEADQUARTERS, DEPARTMENT OF THE ARMY

DECEMBER 1981

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No. 43-0001-30)

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, DC, 1 December 1981

ARMY AMMUNITION DATA SHEETS FOR ROCKETS, ROCKET SYSTEMS, ROCKET FUZES, ROCKET MOTORS

(Federal Supply Class 1340)

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CHAPTER 3

AIRCRAFT ROCKETS
2. 75-Inch

Complete Rounds:

a. Complete rounds can be assembled in the combinations in table 3-1. They may be fired from the M157, M158, M159C, M3 or M200 2. 75-Inch Aircraft Rocket Launchers.

b. The rockets can be issued unassembled. This chapter contains information pertaining to the components of the unassembled rockets.

Table 3-1. 2.75-Inch Complete Round Rocket Combinations

DODAC	Warhead	Motor	Fuze
1340-H459	Flechette (ANTIPERSONNEL) WDU/4A/A	Mk40, Mod 3	Integral
	High Explosive M151		
1340-H470		Mk4, Mods	M427
1340-H471		Mk40, Mod 3	M433
1340-H489		Mk40, Mod 3	M429
1340-H490		Mk40, Mod 3	M423
1340-H161		Mk40, Mod 3	M423
1340-H485		Mk4, Mod 10	M427
	High Explosive M229		
1340-H488		Mk40, Mod 3	M429
1340-H533		Mk40, Mod 3	M427
1340-H534		Mk40, Mod 3	M423
1340-H160		Mk40, Mod 3	M423
1340-H469		Mk40, Mod 3	M433
	Smoke, WP, M156		
1340-H519		Mk40, Mod 3	M423
1340-H486		Mk 4, Mod 10	M427
1340-H593		Mk40, Mod 13	M427
1340-H826	HE, DP	Mk40, Mod 3	M438 M247
1340-H828	Practice, WTU-1/B	Mk40, and Mods	None
1340-H180	Illuminating M257	Mk40	M442
1340-H116	Smoke, Screening WP, M259	Mk40, Mod 3	M446

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2-37. Aircraft Armament Subsystems Rockets.

2.75 inch Rockets*

TYPE	STDZN	PURPOSE	PACKAGING				DOT CLASS	FSC & DODIC	REMARKS Wpn Lchr M158A1 M200A1 M260 M261
			RDS/Per Box	Type	Cu Ft	Wt Lbs			
Rkt 2.75" Flech w/whd WDU-4A/A w/base fuze w/Mtr MK40	A	Anti-Personnel	4 and 25	Wood	3.0 17.9	127 776	A	1340-H459	Same
Rkt 2.75" HE w/whd M229 w/Fuze M429 w/Mtr MK40	A	Anti-Personnel	3, 4 and 25	Wood Wood Wood	3.6 3.47 20.8	134 162 996	A	1340-H488	Same
Rkt 2.75" HE w/whd M151 w/Fuze M429 w/Mtr MK40	A	Anti-Personnel	3, 4 and 25	Wood Wood Wood	3.0 3.0 17.9	107 127 776	A	1340-H489	Same
Rkt 2.75" HE w/whd M151 w/Fuze M423 w/Mtr MK40	A	Anti-Personnel Anti-Materiel	3, 4 and 25	Wood Wood Wood	3.0 3.0 17.9	107 127 776	A	1340-H490	Same
Rkt 2.75" SMK WP M156 w/Fuze M423 w/Mtr MK40	A	Target Marking & Incendiary	4	Wood	3.0	127	A	1340-H519	Same
Rkt 2.75" HE w/whd M229 w/Fuze M423 w/Mtr MK40	A	Anti-Personnel Anti-Materiel	3, 4 and 25	Wood Wood Wood	3.6 3.47 20.8	134 162 996	A	1340-H534	Same
Rkt 2.75" Practice WTU-1/B whd/slug w/Mtr MK40	A	Practice & Training	4 and 25	Wood Wood	3.0 17.9	127 776	B	1340-H828	Same

2-37. Aircraft Armament Subsystems Rockets (Con't).

2.75 Inch Rockets*

TYPE	STDZN	PURPOSE	PACKAGING				DOT CLASS	FSC & DODIC	REMARKS Wpn Lchr M158A1 M200A1 M260 M261
			RDS/Per Box	Type	Cu Ft	Wt Lbs			
Rkt 2.75″ Flare w/whd M257 w/Fuze MBO w/Mtr MK40	A	Target Illumination	3 whds w/fuze, 3 Mtrs unassembled	Wood	3.0	117	A	1340-H180	Same
Rkt 2.75″ Smoke Screening w/whd M259 w/Fuze MBO w/Mtr MK40	A	Battlefield Obscuration	4	Wood	3.5	135	A	1340-H116	Same
Rkt 2.75″ HELP whd M247 w/Fuze PIBD M438 w/Mtr MK40	A	Armor Piercing Anti-Personnel	4	Wood	3.47	147	A	1340-H826	Same
Rkt 2.75″ HE w/whd M151 w/Fuze M433 w/Mtr MK40	A	Selectable Functioning f/Bunker Penetration & Anti-Personnel	4 and 19	Wood Metal	3.0 9.9	127 490	A	1340-H471	M160 & M261 Only

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Field Manual
1-140

Headquarters
Department of the Army
Washington, DC, 29 March 1996

FM 1-140

HELICOPTER GUNNERY

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CHAPTER 1. INTRODUCTION

- Training Strategy
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- Gunnery Tables
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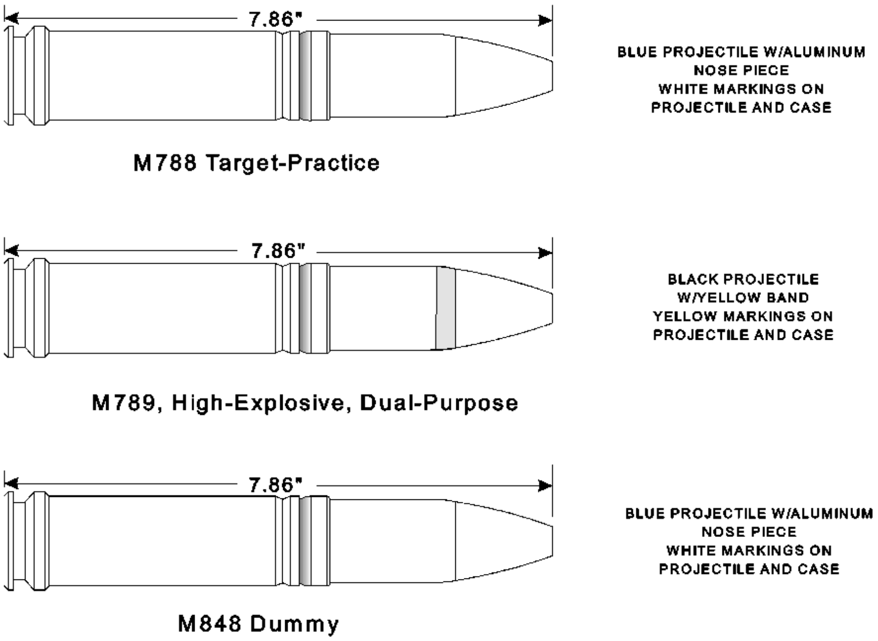

7.86"
BLUE PROJECTILE W/ALUMINUM NOSE PIECE WHITE MARKINGS ON PROJECTILE AND CASE
M788 Target-Practice
7.86"
BLACK PROJECTILE W/YELLOW BAND YELLOW MARKINGS ON PROJECTILE AND CASE
M789, High-Explosive, Dual-Purpose
7.86"
BLUE PROJECTILE W/ALUMINUM NOSE PIECE WHITE MARKINGS ON PROJECTILE AND CASE
M848 Dummy

Figure 5-4. 30mm munitions

d. ***DODACs for 30mm.*** DODACs for linked 30mm ammunition for the M230 cannon are as follows:

- 1305-B120 M788 TP, 72 rounds linked.
- 1305-B118 M788 TP, 11 round carton pack.
- 1305-B130 M789 HEDP, 72 rounds linked.
- 1305-B129 M789 HEDP, 11 round carton pack.
- 1305-B134 M848 Dummy, 72 rounds linked.
- 1305-B133 M848 Dummy, 11 round carton pack.

Section II. Rockets

5-5. 2.75-INCH ROCKETS

a. Hydra 70 is the name associated with the family of 2.75-inch (70 millimeter) rockets. Hydra 70 refers to the Mark 66 rocket motor with any warhead/fuze combination. The MK 66 rocket motor was designed to provide a common 2.75-inch rocket for helicopters and high-performance aircraft. Compared to the MK 40 motor, it has a longer tube, an improved double base solid propellant, and a different nozzle and fin assembly. Increased velocity and spin provide improved trajectory stability for better accuracy. The launch signature and smoke trail have been significantly reduced. The MK 66 Mod 1 is not hazards of electromagnetic radiation to ordnance safe. It can be inadvertently ignited by electromagnetic radiation, especially by radio frequencies found aboard Navy ships. Both the Mod 2 and Mod 3 have HERO filters, and the Mod 2 filter may prevent the AH-1 rocket management system from inventorying. The Mod 1 is the standard motor for Army use as will be the Mod 3 when it is fielded. Figure 5-5 shows the M66 rocket motor.

b. MK 40 rocket motors are no longer produced for the Army. Inventories for training were expected to be exhausted in FY 93. An unknown quantity are held in war reserve stockage. Table 5-5 shows rocket motor comparison data extracted from TM 43-0001-30.

c. M260 and M261 launchers are required to fire the MK 66 rocket. They have reduced system weight and provide remote set fuze interface capabilities. The M158A1 and M200 launchers are not compatible with the MK 66 rocket motor.

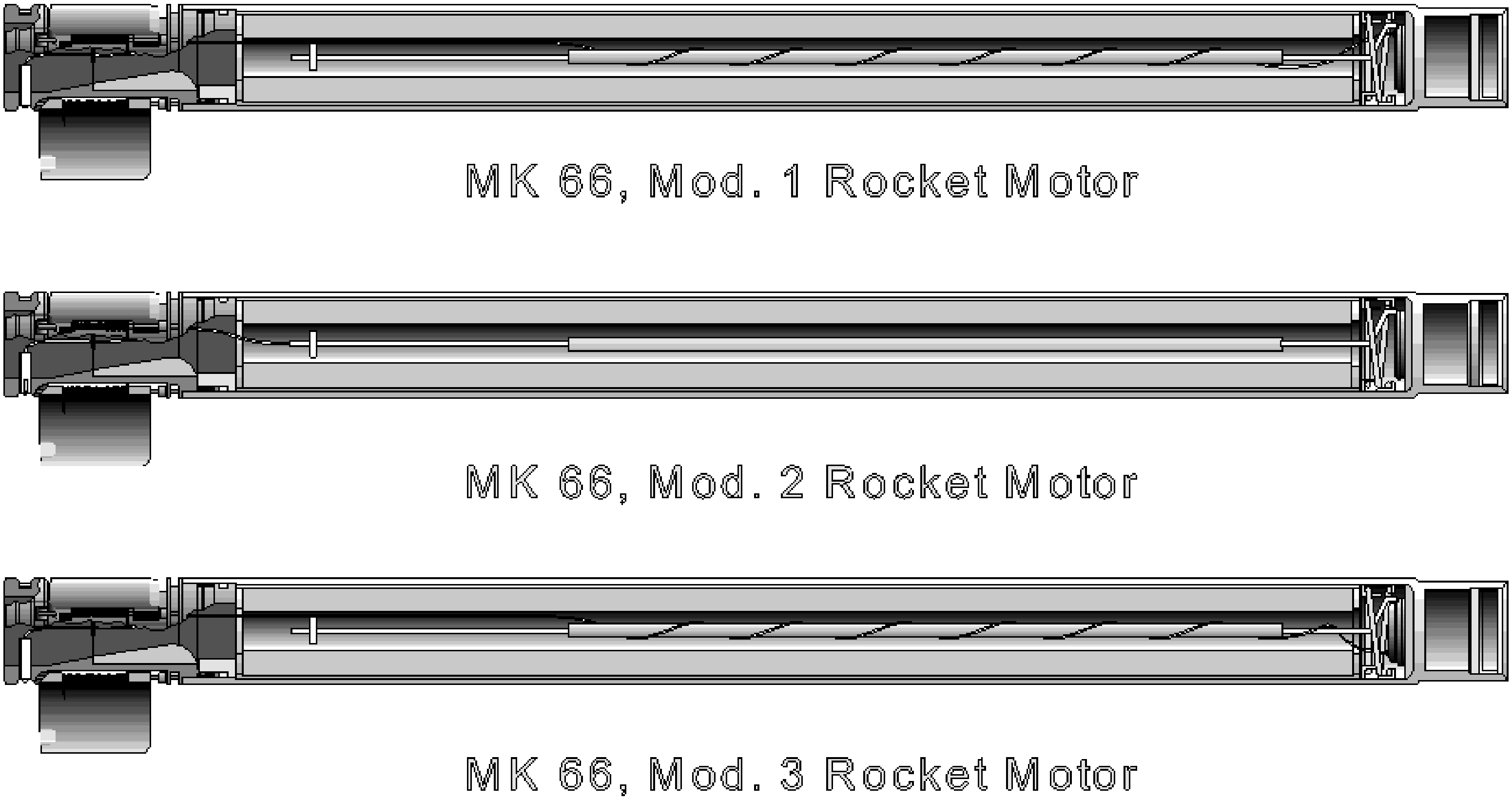

MK 66, Mod. 1 Rocket Motor
MK 66, Mod. 2 Rocket Motor
MK 66, Mod. 3 Rocket Motor

Figure 5-5. MK 66 rocket motors

Table 5-5. Rocket motor comparison data

CHARACTERISTIC	MK 66	MK 40
Length without warhead	41.7 inches	39.3 inches

Weight before firing	13.6 lbs.	11.0 lbs
Motor burn time (77F)	1.05 - 1.1 sec.	1.55 - 1.69 sec.
Average thrust	1,300-1370 lbs.	720 lbs.
Average spin rate	9 - 10 rps	1 rps
Motor burn out	1280 feet (397 m)	1460 feet (445 m)
Velocity at motor burnout	2425 fps	1965 fps
Maximum range at QE 43 degrees (MPSM warhead ground launch)	10,425 meters	8,080 meters

5-6. ROCKET WARHEADS (TACTICAL AND TRAINING)

a. ***M151 High Explosive.*** The M151 HE is an antipersonnel, antimateriel warhead and is traditionally referred to as the "10 Pounder." The bursting radius is 10 meters; however, high velocity fragments can produce a lethality radius in excess of 50 meters. The nose section is constructed of malleable cast iron that is threaded to receive the fuze. The base section is constructed of steel or cast iron and is threaded so that it can be attached to the rocket motor. The base section and the nose section are welded (brazed) together. Total weight of the loaded, unfuzed, warhead is 8.7 pounds, of which 2.3 pounds is composition B4. The M151 can be used M423, M429, and M433 fuzes.

b. ***M274 Smoke Signature (Training).*** This training rocket provides a ballistic match for the M151 HE warhead. The casing is a modified WTU-1/B with vent holes or blowout plugs. A modified M423 fuze mechanism is integral to the warhead. A cylindrical cartridge assembly is in the forward section of the casing; it contains approximately 2 ounces of potassium perchlorate and aluminum powder that provides a "flash, bang, and smoke" signature. The M274 weighs 9.3 pounds.

c. ***M261 High-Explosive Multipurpose Submunition.***

(1) The MPSM warhead provides improved lethality against light armor, wheeled vehicles, materiel, and personnel. It has a plastic nose cone assembly, an aluminum warhead case, an integral fuze, an expulsion charge, and nine M73 submunitions. The primary warhead fuze, M439, is remotely set with the ARCS, MFD, or RMS to provide range settings (time of flight) from 500 meters to approximately 7,000 meters. On the AH-1, the RMS is programmable only from 700 meters to 6,900 meters.

(2) Initial forward motion of the rocket fuze timing. The expulsion charge is initiated at a point before and above the target, approximately 150 meters, depending on the launch angle. The submunitions are separated by ejection, and arming occurs when the ram air declarator deploys. The RAD virtually stops forward velocity and stabilizes the descent of the submunition. An M230 omnidirectional fuze with an M55 detonator is used on each submunition and is designed to function regardless of the impact angle.

(3) Each submunition has a steel body that has a 3.2-ounce shaped charge of composition B for armor penetration. The submunition is internally scored to optimize fragments against personnel and materiel. Upon detonation, the shaped charge penetrates in line with its axis and the submunition body explodes into high velocity fragments (approximately 195 at 10 grains each up to 5,000 feet per second) to defeat soft targets. The fuzed weight of the M261 is 13.6 pounds.

(a) ***Approximate target area coverage*.** Figure 5-6 shows the approximate target area coverage of one M261 warhead. At shorter ranges, the RAD takes longer to overcome momentum, increasing dispersion. As range increases, the rocket loses momentum, increasing the effectiveness of the RAD. This increased effectiveness reduces submunition drift and ground dispersion. Forestation, other vegetation, and natural or man-made structures within the target area may cause the submunition to detonate or land in a dispersion pattern other than the one shown in Figure 5-6.

(b) ***Probability of impact angle*.** Aerodynamic forces affecting submunitions during vertical descent may prevent them from landing upright (0 degrees off center). Sixty-six percent of the time a submunition will land 5 degrees off center; 33 percent of the time a submunition will land 30 degrees off center.

(c) ***MPSM lethality potential*.** Each M73 HE submunition has a shaped charge that can penetrate in excess of 4 inches of armor. A submunition that lands 5 degrees off center has a 90-percent probability of producing casualties against prone, exposed personnel, within a 20-meter radius. A submunition landing 30 degrees off center has a 90-percent probability of producing casualties within a 5 meter radius.

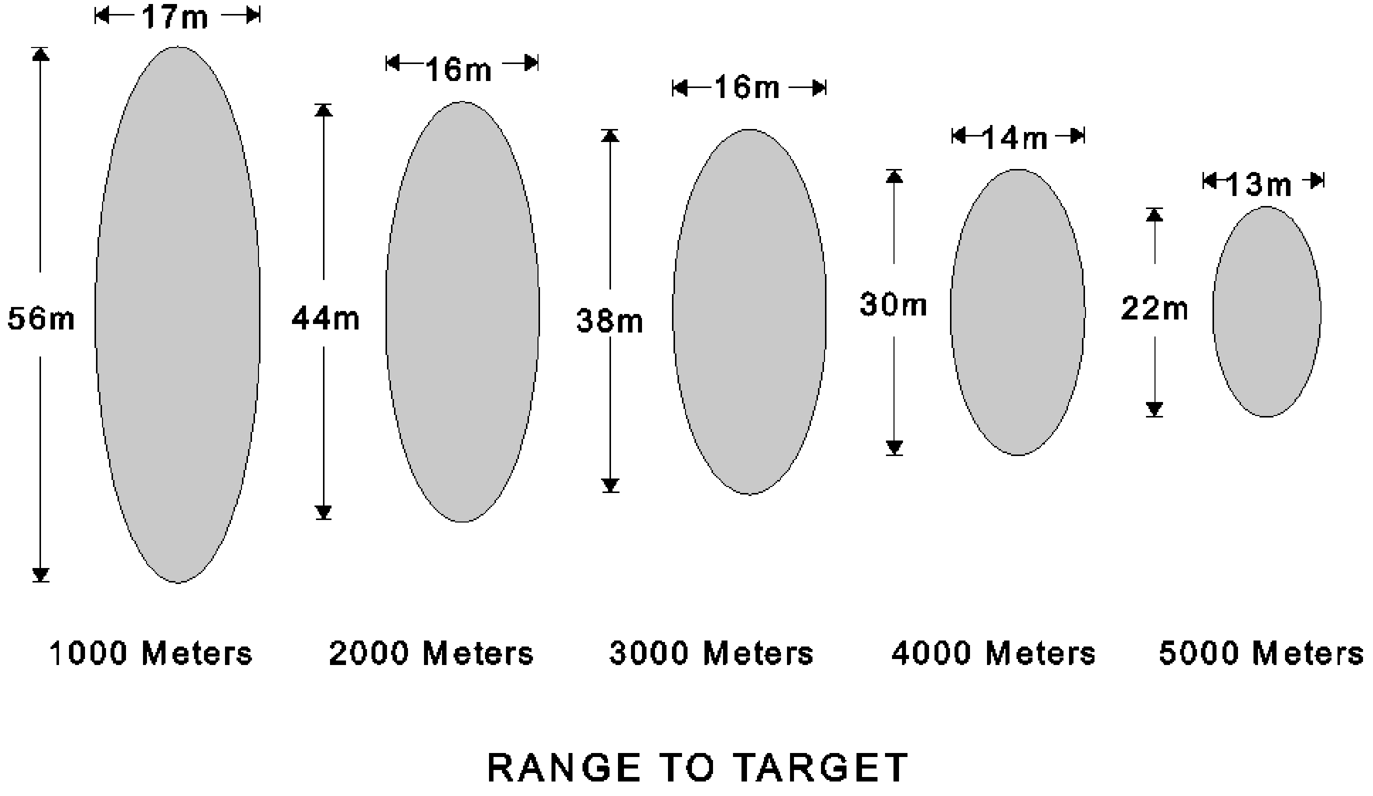


Figure 5-6. Approximate target coverage of one M261 warhead

d. ***M267 MPSM Smoke Signature (Training).*** The M267 MPSM training warhead operationally, physically, and ballistically matches the M261. Three M75 practice submunitions and six inert submunition load simulators take the place of the nine HE submunitions in the M261 warhead. Each practice submunition contains approximately 1 ounce of pyrotechnic powder. An M231 fuze with an M55 detonator is used with practice submunitions.

e. ***M257 Illumination.*** The M257 illumination warhead provides one million candlepower for 100 seconds or more. It can illuminate an area in excess of 1 square kilometer at optimum height. A deployed main parachute descent is approximately 15 feet per second. An M442 integral fuze provides a standoff range of approximately 3,000 meters with the MK 40 motor and approximately 3,500 meters with the MK 66 motor. The weight of the M257 is 10.8 pounds, of which 5.4 pounds is magnesium sodium nitrate.

f. ***M229 High-Explosive.*** The M229 HE warhead is currently in the inventory. An elongated version of the M151, it is commonly referred to as the "17 Pounder." The M229 filler consists of 4.8 pounds of composition B4 and has the same fuzes as the M151. Its unfuzed weight is 16.4 pounds.

g. ***M156 White Phosphorous (Smoke).*** The M156 is primarily used for target marking and incendiary purposes. It ballistically matches the M151 and is of similar construction. Filler for the M156 is 2.2 pounds of WP with a .12-pound bursting charge of composition B. The approximate weight of the fuzed warhead is 9.7 pounds. The M156 uses M423 and M429 fuzes.

h. ***M247 High-Explosive.*** The M247 is no longer in production; however, some of these warheads may still be found in war reserve stockage. With a shape charge for an antiarmor capability, the M247 employs a cone shaped charge like that of the M72 LAW. The point initiated detonating fuze (M438) is an integral part of the warhead. The weight of the M247 is 8.8 pounds, of which 2.0 pounds is composition B.

i. ***M255E1 Flechette.*** The M255E1 flechette warhead, which contains approximately 1,180 60-grain hardened steel flechettes, is in limited production. It is designed for use with the M439 fuze and has possible air-to-air as well as air-to-ground application. Figure 5-7 shows all current production warheads.

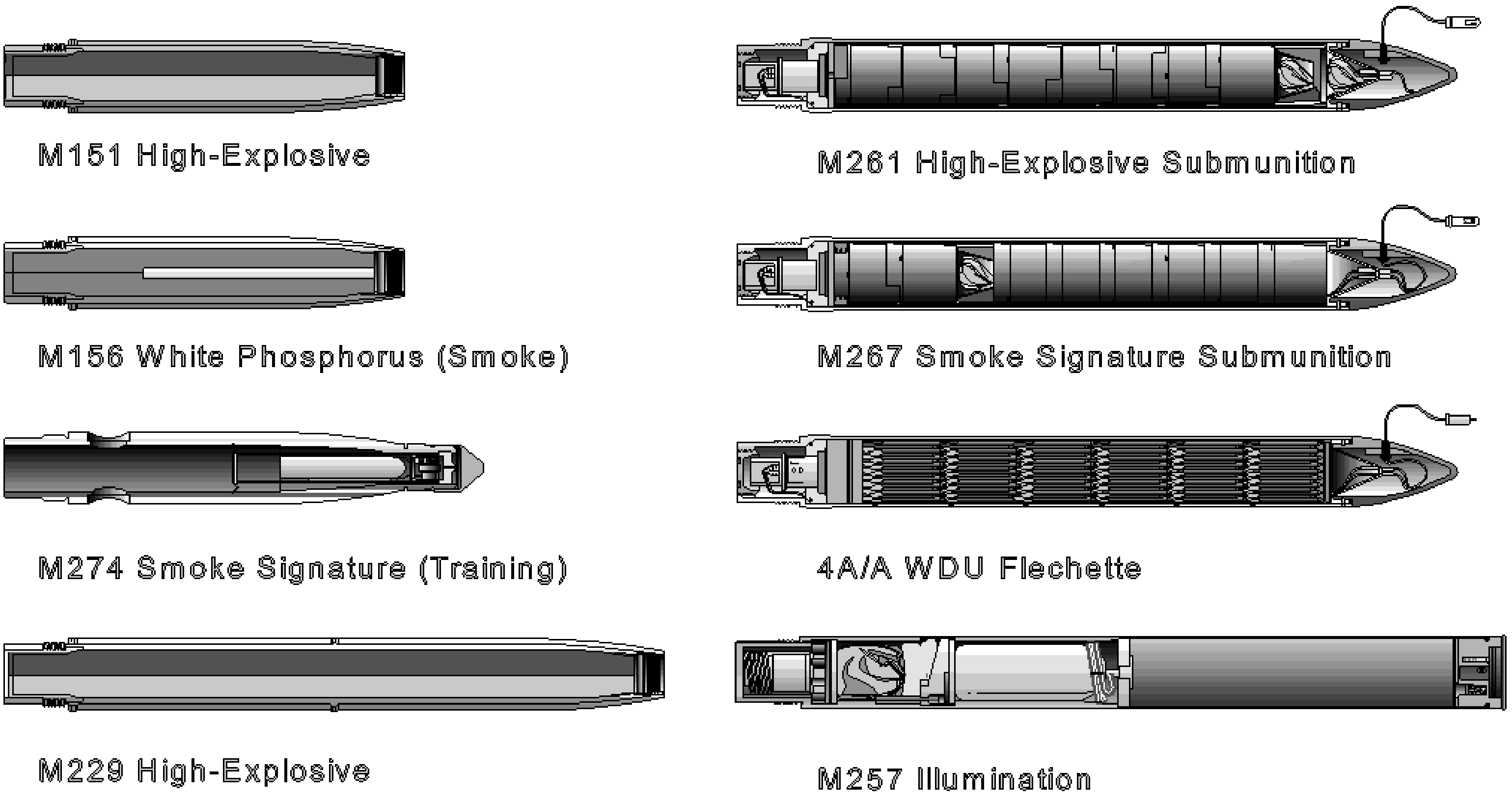

M151 High-Explosive
M261 High-Explosive Submunition
M156 White Phosphorus (Smoke)
M267 Smoke Signature Submunition
M274 Smoke Signature (Training)
4A/A WDU Flechette
M229 High-Explosive
M257 Illumination

Figure 5-7. 70mm warheads in production

5-7. FUZES

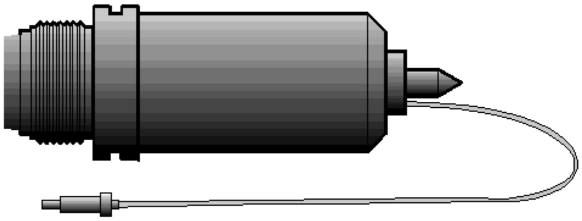
a. ***M423 Point Detonating.*** The M423 PD is an oblique sensitive, point-detonating, superquick fuze used as a common component with the M151. The safety and arming device forward of the booster housing (explosive charge) contains an unbalanced rotor. Upon acceleration of the rocket at firing, a weight setback occurs in the unbalanced rotor assembly which houses the primer and detonator. This setback places the fuze into an armed condition when the rocket has traveled approximately 43 to 92 meters from the launcher.

b. ***M429 Proximity.*** Currently in inventory, the M429 proximity fuze is a transistorized, continuous wave, doppler device that provides air burst functioning for improved antipersonnel effectiveness. The arming mechanism of the M429 is similar to the one in the M423 except that it has been modified to include a battery and an electric detonator. Once it is armed and the reflected signals reach a specific intensity, the firing circuit is initiated through a capacitor to the electric detonator that provides the air burst function. A superquick impact switch serves as a backup to the air burst electronics. (**WARNING:** Multiple firing of rockets with this fuze is not permitted [no pairs, no salvos, or ripple fire]. Fire in single rocket mode only. Radio frequency interference between fuzes can cause premature functioning.)

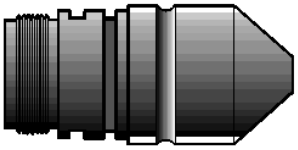
c. ***M433 Resistance Capacitance.*** The M433 RC is a nose mounted, multioption, time delay fuze with selectable functioning modes. A superquick setting is used for open terrain; a forest penetration mode permits a selectable time delay range (10 to 45 meters in 5-meter increments) set for the height of the forest canopy. After first contact with the forest canopy, a delay timer is activated to provide warhead functioning. The bunker or building penetration mode provides up to 10 feet of penetration before detonation. The target penetration RC timer is activated by a point mounted probe switch that is initiated by target contact. An umbilical assembly is positioned on the nose of the fuze for interface through the launcher and RMS or ARCS and the aircraft. When the trigger is pulled, aircraft voltage is supplied to the fuze and the time delay is initiated as selected by the pilot.

d. ***M439 Resistance Capacitance.*** The M439 RC is a base mounted, electronic variable, time delay fuze with an RC delay circuit. Designed for cargo and flechette warheads, the M439 allows the pilot to remotely set the fuze for air burst functioning at the desired range from 500 to 7,200 meters. A fuze capacitor is charged by the RMS, ARCS, or MFD through an umbilical assembly. The fuze has no internal battery, and the required voltage is supplied by the aircraft through the remote set fuze subsystem. When the rocket is fired and normal acceleration occurs, the fuze is armed and timing starts. If the fuze is set but the rocket motor fails to fire, the rocket should not be loaded into another tube and fired. When the fuze is set a second time, it will function longer than the set time and should not be used for accurate measurement until 10 days has elapsed before resetting it. The detonator is initiated electrically, depending on the range setting (time of flight), and ignites the expelling charge. Figure 5-8 shows production fuzes.

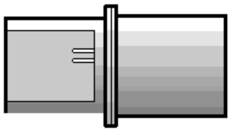
e. ***M422/M446 Fuzes.*** The M442 and M446 fuzes are base mounted, air burst, motor burnout delayed fuzes. They are integral fuzes used with the M257 illumination and M259 WP smoke rockets, respectively.



M433 Resistance Capacitance Fuze



M423 Point-Detonating Fuze



M439 Resistance Capacitance Fuze

Figure 5-8. 70mm fuzes

f. ***DODACs for Rockets***. DODACs for rockets (complete round with MK 66 motors) are listed in Table 5-6 :

Table 5-6. DODIC/NSN cross reference for select HYDRA-70,

2.75-inch rocket items

COMPLETE ROUNDS DODIC	NSN	CONFIGURATION	PACK
H154	1340-01-371-8611	M278/M442/MK66-2	6
H165	1340-01-269-1447	M261/M439/MK66-3	4
H181	1340=01-249-7721	M257/M442/MK66-1	3
H182	1340-01-249-7720	M257/M442/MK66-2	3
H183	1340-01-268-7175	M257/M442/MK66-3	3
H184	1340-01-289-4719	M264/M439/MK66-3	4
H462	1340-01-309-5799	M255/M439/MK66-3	4

H463	1340-01-108-8849	M267/M439/MK66-1	4
H464	1340-01-108-8850	M261/M439/MK66-1	4
H582	1340-01-269-9122	M151/M433/MK66-3	4
H583	1340-01-269-9123	M151/M423/MK66-3	4
H642	1340-01-309-8300	M229/M423/MK66-2	4
H973	1340-01-238-2068	M274/ N/A /MK66-2	4
H972	1340-01-238-2067	M274/ N/A /MK66-1	4
H974	1340-01-268-7174	M267/M439/MK66-3	4
H975	1340-01-269-1446	M274/ N/A /MK66-3	4
H163	1340-01-108-8851	M151/M423/MK66-1	4
H164	1340-01-110-2672	M151/M433/MK66-1	4

NOTE: Due to the various models of rockets, warheads, and fuze combinations possible and the number of those that are undergoing classification or awaiting production contracts, a comprehensive list is not possible. TM 43-0001-30 gives additional information on rockets and rocket systems, fuzes, and motors. To obtain additional information about the Hydra 70, 2.75-inch rocket, write the US Army Armament, Munitions, and Chemical Command, ATTN: AMSMC-ASH, Rock Island, IL 61299-6000.

Section III. Missiles

5-8. MISSILE CONFIGURATIONS

The Hellfire surface attack guided missile is currently available in three configurations: dummy, training, and tactical. All Hellfire missiles are 7 inches in diameter, and have a wingspan of 13 inches. The missile weighs 99.5 pounds and is 64 inches long except for the AGM-114F that is 7 pounds heavier and 7 inches longer. Color codes and data markings for the Hellfire missile are as follows:

- The basic color of missile is black.

- Data markings are olive drab.

- Markings on the aft end are four brown 3-inch squares 90 degrees apart (brown means solid propellent).

destruction mission. Destruction often requires large expenditures of ammunition.

(1) Destruction is a deliberate engagement.

(2) Precision guided missiles are used against hard targets during destruction missions. While other weapons may be used for destruction, mission planning will normally focus on the standoff capability of TOW and Hellfire missiles.

Section II. Terminology and Information on Weapons

7-4. EFFECTIVE RANGE

FM 101-5-1 defines effective range as, "That range at which a weapon or weapons system has a 50 percent probability of hitting a target."

a. A weapon's effective range extends from the minimum effective range to the maximum effective range. **Maximum effective range** is the longest range at which a weapon has a 50-percent probability of hitting a target.

b. The standard target used in determining effective range for cannon are 3 x 3 meter plywood silhouettes. It is a "vehicle sized" target.

c. The training tables contained in this manual require aircrews to engage targets within the effective range of the weapon with target-practice ammunition. However, crews may have to shoot long range engagements in combat using service ammunition.

7-5. 2.75-INCH ROCKETS

Whether fired from an AH-64, AH-1, or OH-58D (KW), the 2.75-inch rocket system displays similar characteristics. The intent of the following paragraphs is to provide general information applicable to all armed helicopters.

a. The rocket system mounted on attack helicopters is a unique weapon system. Rockets fired from an attack helicopter possess characteristics of both direct and indirect fire weapons. Like indirect artillery fire, 2.75-inch rockets are most effective when fired in mass. In addition, helicopter crews can fire rockets in the direct fire and indirect fire mode.

b. Crews can expect 7 to 12 mils of dispersion from rockets fired from helicopters. The MK 66 rocket motor spins clockwise up to 30 revolutions per second to motor burnout due to the flutes on the motor nozzle. As the motor burns out the rocket's clockwise rotation zeroes out and the wrap-around fins cause the rocket to begin a rapid counterclockwise rotation. Engineers designed this reversal of rotation for the following reasons:

(1) The rocket's high rate of rotation may keep the warhead's set-back fuze from arming due to the centrifugal force of the spinning rocket.

(2) The MPSM warhead's submunition ejection pattern is disrupted by high rates of rotation. The pattern of submunition impacts is inconsistent and provides poor target coverage without proper submunition ejection.

c. Live-fire testing shows that rockets are most effective between 3,000 and 5,000 meters. These test results apply to both MPSM and unitary warhead rockets.

d. Crews must select the proper weapon for the target to be engaged. The targets most suited for rockets are large target areas with high concentrations of enemy personnel and materiel. Figure 7-1 shows an example of a rocket target. The targets best suited for neutralization with rockets include--

(1) Troops in the open.

(2) Tactical assembly areas.

(3) Command, control, and communications facilities.

(4) Motor parks and vehicle marshalling area.

(5) Convoys of thin-skinned vehicles.

(6) River crossing sites.

(7) Deployed artillery or air defense sites.